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# Assessing prognosis with modified early warning score, rapid emergency medicine score and worthing physiological scoring system in patients admitted to intensive care unit from emergency department

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ABSTRACT

*Introduction:* In this study our purpose is to examine the effectiveness and reliability of MEWS (Modified Early Warning Score), REMS (Rapid Emergency Medicine Score) and WPS (Worthing Physiological Scoring System) scoring systems for prediction of the prognosis and mortality rate of critically ill patients scheduled to be admitted to intensive care unit (ICU) among emergency department (ED) patients.

*Methods:* This single-centered retrospective study was performed on medical, surgical and trauma patients referred to the ED and admitted to ICU of University Hospital between 23 July 2013 and 26 November 2015.

*Results:* Mortality and the duration of stay in ICU were significantly correlated with systolic blood pressure (SBP) and WPS score compared to other variables ($p = 0.014$, $p = 0.010$ respectively). The decrease in SBP increased the mortality by 2 (OR: %95 CI 1.1–3.5) fold and the increase in WPS increased the mortality by 2.4 (OR: %95 CI 1.2–4.5) fold.

*Conclusions:* In our study, there was a more significant correlation between WPS score and mortality and duration of stay in ICU compared to other scores.

## 1. Introduction

Emergency departments are the main gates of the health care system. The increasing number of emergency patients, the prolongation of emergency patients' stay in emergency departments and the overcrowding in emergency departments make critical patient detection important [1]. In recent years, scoring systems have been proposed to determine which patients need intensive observation, treatment, and nursing care, which patients should be monitored and supported in intensive care conditions, and how to make this distinction in a quality and effective manner [1,2]. RAPS (Rapid Acute Physiology Score), REMS (Rapid Emergency Medicine Score), WPS (Worthing Physiological Scoring System), MEWS (Modified Early Warning Score), MEDS (Mortality in Emergency Department Sepsis) are some of these scoring systems used.

Due to resource limitations, the number of patients who can be followed and treated in the intensive care units is limited. Therefore the choice of patients for which critical care may be beneficial is very important. The suboptimal care before admission to the intensive care unit leads to increased mortality [3].

Studies involving different scoring systems have been carried out for patients who were admitted to the emergency department, but there is no study that examines MEWS, REMS and WPS together [4]. The purpose of this study is to examine the efficacy and reliability of the MEWS, REMS and WPS scoring systems in predicting the prognosis and the mortality rates of critically ill patients planning to be admitted to the intensive care unit among emergency patients.

## 2. Methods

### 2.1. Study design

A total of 250 patients, who were 18 years old and applied to the emergency department between July 23, 2013 and November 26, 2015 and were transferred to the emergency intensive care unit due to internal diseases, surgery, and trauma were included in the study. The patients who were stayed in the emergency department during the evaluation process after arriving at the hospital but were taken to the intensive care unit after responding to an appropriate intervention were also included in the study.

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**Table 1**
Modified early warning score.

| | 3 | 2 | 1 | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|---|---|
| Systolic blood pressure (mmHg) | < 70 | 71–80 | 81–100 | 101–199 | | ≥200 | |
| Heart rate (bpm) | | < 40 | 41–50 | 51–100 | 101–110 | 111–129 | ≥130 |
| Respiratory rate (bpm) | | < 9 | | 9–14 | 15–20 | 21–29 | ≥30 |
| Temperature (°C) | | < 35 | | 35–38.4 | | ≥38.5 | |
| AVPU score | | | | Alert | Reacting to voice | Reacting to pain | Unresponsive |

Patients who were brought to the emergency department as dead and those who were less than 18 years of age and were discharged or hospitalized except for the intensive care unit and about whom there was not enough record were excluded from the study.

Patients who have been admitted to the intensive care unit between the dates specified have been examined by screening patient files from the program being used at our hospital.

### 2.2. Measurements

The prognoses of the selected patients were compared using MEWS, REMS and WPS scoring systems.

MEWS consists of 5 physiological parameters. If the total score is 5, then patients are evaluated to be critical (Table 1) [4].

REMS consists of 6 parameters, 5 physiological and 1 age [4]. The highest score is 26. The scores lower than 5 are evaluated to be the low risk, between 5≤ and ≤13 to be the moderate risk, and above 13 to be the high risk (Table 2).

The WPS score is also evaluated on 6 parameters [5]. The total score is between 0 and 13. The scores lower than 3 are evaluated to be the low risk, between 3 and 5 to be the moderate risk, and 5 and above to be the high risk (Table 3).

### 2.3. Data analysis

SPSS 22.0 (IBM Corporation, Armonk, New York, United States) and Medcalc 14 (Acacialaan 22, B-8400 Ostend, Belgium) programs were used to analyze the variables. The Independent-Samples *T* test and the Mann-Whitney *U* test were used to compare two independent groups according to quantitative data. The Pearson Chi-Square and Fisher Exact tests were used to compare the categorical variables. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) which show the relationship between the classification separated by the cut-off value calculated according to the variables of the deceased and the survivals as per mortality and the real classification was expressed after being analyzed and stated with the ROC (Receiver Operating Curve). In the tables, the quantitative variables were shown as mean ± SD (standard deviation) and categorical variables as n (%). The p-value of less than 0.05 was considered significant.

**Table 2**
Rapid emergency medicine score.

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Age | < 45 | | 45–54 | 55–64 | | 65–74 | > 74 |
| Heart rate (bpm) | 70–109 | | 55–69<br>110–139 | 40–54<br>140–179 | < 40<br>> 179 | | |
| Respiratory rate (bpm) | 12–24 | 10–11<br>25–34 | 6–9 | 35–49 | < 6<br>> 49 | | |
| Mean arterial pressure (mmHg) | 70–109 | | 50–69<br>110–129 | 130–159 | < 49<br>> 159 | | |
| Glasgow coma scale | > 13 | 11–13 | 8–10 | 5–7 | < 5 | | |
| Oxygen sat. (bpm beats per minute) | > 89 | 86–89 | | 75–85 | < 75 | | |

**Table 3**
Worthing physiological scoring system.

| | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Ventilatory frequency | ≤19 | 20–21 | ≥22 | |
| Pulse | ≤101 | ≥102 | | |
| Systolic blood pressure | ≥100 | | ≤99 | |
| Temperature | ≥35.3 | | | < 35.3 |
| Oxygen saturation in air | 96–100 | 94 and < 96 | 92 and < 94 | < 92 |
| AVPU | Alert | | | Other |

## 3. Results

The mean age of the 250 patients included in the study was 57.60 ± 20.82 years (max–min 96–18), and of the patients, 144 (57.6%) were male and 106 (42.4%) were female. The mean MEWS score was determined to be 3.43 ± 2.34, the mean WPS score to be 4.56 ± 3.13 and the mean REMS score to be 7.48 ± 4.74. Mean duration of intensive care unit stay was 9.69 ± 13.14 days (Table 4).

Of the patients admitted to the intensive care unit from the emergency department, 65 (26%) were admitted with the diagnosis of respiratory insufficiency 38 (15.2%) of pneumonia, and 29 (11.6%) of CVD (Cerebrovascular disease), 10.8% stayed in the ICU due to trauma, 11.2% due to chronic diseases, 7.6% due to drug intoxication, 17.6% due to other – substance use, electric shock, gastrointestinal bleeding, acute renal failure, pulmonary embolism, epilepsy, syncope etc. Of the 250 patients included in the study, 54 (21.6%) died after being admitted to the intensive care unit, 103 (41.2%) were discharged from the hospital, 86 (34.4%) were admitted to another service, and 7 (2.8%) were taken out of the intensive care unit due to other reasons.

The patients were divided into four groups according to their situations of ending up in the intensive care unit as discharge,

**Table 4**
Vital signs and score of patients.

| | Average ± SD | Median | Maximum | Minimum |
|---|---|---|---|---|
| Age | 57.60 ± 20.82 | 59.0 | 96.0 | 18.0 |
| Respiratory rate (bpm) | 20.27 ± 6.97 | 18.0 | 37.0 | 5.0 |
| Pulse (bpm) | 100.41 ± 25.78 | 98.0 | 210.0 | 40.0 |
| Systolic blood pressure (mmHg) | 129.45 ± 31.17 | 130.0 | 240.0 | 60.0 |
| Diastolic blood pressure (mmHg) | 77.54 ± 18.92 | 79.0 | 140.0 | 40.0 |
| Temperature (°C) | 365.43 ± 8.31 | 363.0 | 399.0 | 345.0 |
| Oxygen saturation | 87.76 ± 13.85 | 94.0 | 100.0 | 33.0 |
| Glasgow coma scale | 12.58 ± 3.36 | 14.0 | 15.0 | 3.0 |
| Duration of ICU stay (day) | 9.69 ± 13.14 | 5.5 | 143.0 | 1.0 |
| Modified early warning score (MEWS) | 3.43 ± 2.34 | 3.0 | 12.0 | 0.0 |
| Worthing physiological scoring system (WPS) | 4.56 ± 3.13 | 5.0 | 13.0 | 0.0 |
| Rapid emergency medicine score (REMS) | 7.48 ± 4.74 | 8.0 | 23.0 | 0.0 |

SD: standard deviation.

**Table 5**
Binary comparison of patients' intensive care units according to their status of termination.

| | The reason for exit from ICU | | | | General | p for binary comparison | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Discharge = I (n = 103) | Service addmission = II (n = 86) | Ex = III (n = 54) | Other = IV (n = 7) | p | I–II | I–III | I–IV | II–III | II-IV | III-IV |
| | Average ± SD | Average ± SD | Average ± SD | Average ± SD | | | | | | | |
| Age | 51.93 ± 21.64 Med. (Max.-Min.) | 60.01 ± 19.94 Med. (Max.-Min.) | 66.35 ± 15.33 Med. (Max.-Min.) | 44.00 ± 27.89 Med. (Max.-Min.) | < 0.001 | 0.041 | < 0.001 | 0.879 | 0.153 | 0.494 | 0.253 |
| Respiratory rate (bpm) | 18 (37–10) | 20 (35–7) | 20 (33–5) | 12 (18–10) | 0.076 | Nm | Nm | Nm | Nm | Nm | Nm |
| Pulse (bpm) | 90 (157–46) | 96.5 (210–40) | 111 (200–49) | 98 (145–76) | 0.056 | Nm | Nm | Nm | Nm | Nm | Nm |
| Systolic blood pressure (mmHg) | 130 (220–70) | 130 (240–70) | 115.5 (190–60) | 130 (180–100) | 0.018 | 1 | 0.027 | 1 | 0.01 | 1 | 0.607 |
| Diastolic blood pressure (mmHg) | 80 (120–40) | 80 (140–40) | 70 (140–40) | 76 (97–53) | 0.009 | 1 | 0.001 | 1 | 0.02 | 1 | 1 |
| Temperature (°C) | 363 (390–345) | 363.5 (399–358) | 363 (395–350) | 361 (385–360) | 0.101 | Nm | Nm | Nm | Nm | Nm | Nm |
| Oxygen saturation | 97 (100–53) | 92.5 (100–33) | 89.5 (100–45) | 98 (100–70) | < 0.001 | 0.033 | < 0.001 | 1 | 0.038 | 0.716 | 0.015 |
| Glasgow coma scale | 15 (15–3) | 15 (15–3) | 12 (15–3) | 13 (15–5) | < 0.001 | 0.821 | < 0.001 | 1 | 0.003 | 1 | 1 |

OneWay ANOVA – Post Hoc Test Gomes Howell, Kruskal Wallis Test (Monte Carlo) – Post Hoc Test: Dunn's Test – Med.: median – Min.: minimum – Max.: maximum – Nm: not meaning – SD: standard deviation.

hospitalization, death, and others (those who reject treatment or left the intensive care unit due to other reasons). These four groups were compared in pairs. In these pair wise comparisons, statistically significant differences were seen between the SBP (Systolic blood pressure), DBP (Diastolic blood pressure), oxygen saturation and GCS (Glasgow coma scale) median values ($p < 0.001$, $p = 0.018$, $p = 0.009$, $p < 0.001$, $p < 0.001$, respectively) (Table 5).

Statistically significant differences were seen between those who received 5 >, 5≤ points from the MEWS score, 5 >, 5–13, 13 < points from the REMS score and 3 >, 3–5, 5 < points from the WPS score in terms of the 1st, 5th and 28th day mortality in the intensive care unit. The 1st day MEWS score in the intensive care unit was 5≤ in 60% of those who died and in 11.8% of those who survived and this difference was statistically significant ($p = 0.001$). Among the patients who died on the first day, the rate of those whose MEWS score was 5≤ was 11.2 times more than that of those who survived, and this was statistically significant [95% confidence interval (CI) (2.6–48.8)] (Table 6).

According to the five-day mortality, while 100% of those who had the WPS score of 3 > survived, 0% death was seen at this point. While 82.8% of those who received 3–5 points survived, 17.2% died. Finally, while 50% of those who received 5≤ points survived, 50% died ($p < 0.001$) (Table 6).

When the 28-day mortality was evaluated, significant differences were seen between the survivors and the deceased in terms of the MEWS, REMS and WPS scores ($p < 0.001$) (Table 6). Again, this difference showed that when all three scores increased the death increased.

The cut-off values calculated for the survivors and non-survivors were found as 62 for age, 113 for SBP, 77 for DBP, 97 for oxygen saturation, 14 for GCS, 3 for MEWS score, 5 for WPS score, 6 for REMS score, and this is statistically significant ($p < 0.001$) (Table 7).

When the MEWS score was 3, its specificity was 61.7%, sensitivity was 68.5%, PPV was 33% and NPV was 87.7%.When the WPS score was 5, its specificity was 69.4%, sensitivity was 72.2%, PPV 39.4%, and NPV 90.1%. While the REMS score was 6, its specificity was 48.5%, sensitivity was 83.3%, PPV was 30.8% and NPV was 91.3% (Table 7).

In the ROC analysis performed, the AUC value of the WPS score (0.769 ± 0.034) was found to be higher than the AUC values of the REMS (0.703 ± 0.036) and MEWS (0.711 ± 0.039). WPS was found to be more successful than REMS and MEWS in predicting mortality and prognosis (Table 7, Fig. 1).

The variables were analyzed in terms of mortality and duration of stay in the intensive care unit. The mortality and the duration of stay in the intensive care unit were seen to have a more significant relationship with SBP and WPS compared to the other variables ($p = 0.014$, $p = 0.010$, respectively). The decrease in SBP doubled the mortality rate, and the increase in WPS increased the mortality rate 2.4 times (Table 8).

## 4. Discussion

The number of patients that were admitted to the emergency departments is increasing every passing day [6]. In emergency services with limited resources (staff, tools, equipment, etc.) and time, it becomes difficult to identify critical patients, and appropriate treatment and early intervention may be delayed [6]. It is aimed to maximize the efficiency of the use of resources with the risk assessment scoring systems developed for the identification of the high-risk patients and to minimize their risks [7,8]. Many studies have been carried out on these scoring systems developed and the studies in this particular are still going on. However, as far as we know, there is no study in the literature which compares the REMS, MEWS and WPS scores in all for patients who were admitted to the emergency department.

In the prospective study by Ha et al., which includes non-surgical patients who are admitted to the emergency department, the mean age is 65.9 and the mortality rate is 9.9% (172). The REMS and WPS scores were compared in terms of 30-day mortality and the AUC value was found to be 0.797 (95% CI: 0.762–0.831) for WPS and to be 0.712 (95% CI: 0.668–0.756) for REMS. The WPS score was found to be superior to the REMS score in terms of prognostic performance [6]. In this study performed on 250 patients, the mean age is 57.6 and the mortality rate is 21.6% (54). The reason why the mortality rate is higher is that all of the patients are those who stay in the intensive care unit. In the present study, the AUC value was found to be 0.769 (OR 7.06, 95% CI: 3.48–14.3) for WPS and to be 0.703 (OR 5.09 95% CI: 5.09–11.4) for REMS for the prediction of hospital mortality. Similarly, the WPS score was found to be superior to the REMS and MEWS scores in terms of prognostic performance.

In the study where the relationship between the MEWS score and the stay in the intensive care unit and 60-day mortality was analyzed in 673 patients who were admitted due to acute internal diseases, the increase of ≥5 in MEWS was found to be associated with the increased death risk (OR 5.4, 95% CI 2.8–10.7) and increased stay in the intensive care unit (OR 10.9, 95% CI 2.2–55.6). It is stated that the MEWS can be easily applied to emergency care and used in the detection of high-risk

**Table 6**
Comparison of mortality on days 1, 5, and 28 compared to MEWS, REMS and WPS scores.

| | | | Mortality | | | | | | p, OR (%95 CI)* |
|---|---|---|---|---|---|---|---|---|---|
| | | | Alive | | | Ex | | | |
| | | | n | Line% | Column% | n | Line% | Column% | |
| 1 day | MEWS score | 5 > | 30 | 83.3% | 88.2% | 6 | 16.7% | 40.0% | < 0.001 |
| | | 5≤ | 4 | 30.8% | 11.8% | 9 | 69.2% | 60.0% | 11.2 (2.6–48.8)* |
| | REMS score | 5 > | 24 | 100.0% | 70.6% | 0 | 0.0% | 0.0% | < 0.001 |
| | | [5–13] | 10 | 50.0% | 29.4% | 10 | 50.0% | 66.7% | |
| | | 13 < | 0 | 0.0% | 0.0% | 5 | 100.0% | 33.3% | |
| | WPS score | 3 > | 20 | 100.0% | 58.8% | 0 | 0.0% | 0.0% | < 0.001 |
| | | [3–5) | 10 | 83.3% | 29.4% | 2 | 16.7% | 13.3% | |
| | | 5≤ | 4 | 23.5% | 11.8% | 13 | 76.5% | 86.7% | |
| ≤5 day | MEWS score | 5 > | 80 | 86.0% | 84.2% | 13 | 14.0% | 43.3% | < 0.001 |
| | | 5≤ | 15 | 46.9% | 15.8% | 17 | 53.1% | 56.7% | 6.9 (2.8–17.3)* |
| | REMS score | 5 > | 51 | 94.4% | 53.7% | 3 | 5.6% | 10.0% | < 0.001 |
| | | [5–13] | 41 | 67.2% | 43.2% | 20 | 32.8% | 66.7% | |
| | | 13 < | 3 | 30.0% | 3.2% | 7 | 70.0% | 23.3% | |
| | WPS score | 3 > | 46 | 100.0% | 48.4% | 0 | 0.0% | 0.0% | < 0.001 |
| | | [3–5) | 24 | 82.8% | 25.3% | 5 | 17.2% | 16.7% | |
| | | 5≤ | 25 | 50.0% | 26.3% | 25 | 50.0% | 83.3% | |
| ≤28 day | MEWS score | 5 > | 135 | 84.9% | 74.6% | 24 | 15.1% | 47.1% | < 0.001 |
| | | 5≤ | 46 | 63.0% | 25.4% | 27 | 37.0% | 52.9% | 3.3 (1.7–6.3)* |
| | REMS score | 5 > | 66 | 91.7% | 36.5% | 6 | 8.3% | 11.8% | < 0.001 |
| | | [5–13] | 108 | 76.1% | 59.7% | 34 | 23.9% | 66.7% | |
| | | 13 < | 7 | 38.9% | 3.9% | 11 | 61.1% | 21.6% | |
| | WPS score | 3 > | 60 | 96.8% | 33.1% | 2 | 3.2% | 3.9% | < 0.001 |
| | | [3–5) | 45 | 84.9% | 24.9% | 8 | 15.1% | 15.7% | |
| | | 5≤ | 76 | 65.0% | 42.0% | 41 | 35.0% | 80.4% | |

Pearson Chi Square Test (Monte Carl) – Fisher Exact (Exact).
* OR (%95 CI): Odds Ratio (%95 Confidence Interval).

patients for the admission to the intensive care unit [3]. It was stated that NEWS could easily be applied in the emergency department and used in the identification of the high-risk patients for the ICU stay. Similarly, in the present study, the risk of death was high in those with MEWS ≥ 5. Namely, among the patients who died on the first day, the rate of those whose MEWS score was 5≤ was 11.2 times more than that of those who survived, and this was statistically significant (95% CI 2.6–48.8). The risks of death on the 5th and 28th day were determined to be 6.9 (95% CI 2.8–17.3) and 3.3 (95% CI 1.7–6.3), respectively, in patients with MEWS score ≥5.

In a prospective study by Ghanem-Zoubi et al., the MEWS, MEDS, REMS and SCS (Simple Clinical Score) scores were analyzed to predict the hospital mortality of 1072 patients who were hospitalized with the diagnosis of sepsis in the general internal medicine department of a

**Table 7**
Cut-off value of variables and scores.

| | | Mortality | | | | | | AUC ± Se | Odds Ratio (%95 CI) | P |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Alive | | | Ex | | | | | |
| | | n | Line% | Column% | n | Line% | Column% | | | |
| Age | 62≥ | 118 | (86.8)[d] | (60.2)[b] | 18 | (13.2) | (33.3) | 0.647 ± 0.037 | 3.10 (1.61–5.96)* | < 0.001 |
| | 62 < | 78 | (68.4) | (39.8) | 36 | (31.6)[c] | (66.7)[a] | | | |
| Systolic blood pressure (mmHg) | 113 < | 153 | (85.0)[d] | (78.1)[b] | 27 | (15.0) | (50.0) | 0.636 ± 0.047 | 4.34 (2.24–8.41)* | 0.004 |
| | 113≥ | 43 | (61.4) | (21.9) | 27 | (38.6)[c] | (50.0)[a] | | | |
| Diastolic blood pressure (mmHg) | 77 < | 113 | (86.3)[d] | (57.7)[b] | 18 | (13.7) | (33.3) | 0.640 ± 0.046 | 3.16 (1.63–6.13)* | 0.002 |
| | 77≥ | 83 | (69.7) | (42.3) | 36 | (30.3)[c] | (66.7)[a] | | | |
| Oxygen saturation | 97 < | 79 | (92.9)[d] | (40.3)[b] | 6 | (7.1) | (11.1) | 0.657 ± 0.038 | 5.31 (2.15–13.07)* | < 0.001 |
| | 97≥ | 117 | (70.9) | (59.7) | 48 | (29.1)[c] | (88.9)[a] | | | |
| Glasgow coma scale | 14 < | 111 | (91.7)[d] | (56.6)[b] | 10 | (8.3) | (18.5) | 0.692 ± 0.038 | 5.79 (2.73–12.29)* | < 0.001 |
| | 14≥ | 85 | (65.9) | (43.4) | 44 | (34.1)[c] | (81.5)[a] | | | |
| MEWS score | 3≥ | 121 | (87.7)[d] | (61.7)[b] | 17 | (12.3) | (31.5) | 0.711 ± 0.039 | 3.90 (1.99–7.64)* | < 0.001 |
| | 3 < | 75 | (67.0) | (38.3) | 37 | (33.0)[c] | (68.5)[a] | | | |
| WPS score | 5≥ | 136 | (90.1)[d] | (69.4)[b] | 15 | (9.9) | (27.8) | 0.769 ± .0.034 | 7.06 (3.48–14.31)* | < 0.001 |
| | 5 < | 60 | (60.6) | (30.6) | 39 | (39.4)[c] | (72.2)[a] | | | |
| REMS score | 6≥ | 95 | (91.3)[d] | (48.5)[b] | 9 | (8.7) | (16.7) | 0.703 ± 0.036 | 5.09 (2.26–11.42)* | < 0.001 |
| | 6 < | 101 | (69.2) | (51.5) | 45 | (30.8)[c] | (83.3)[a] | | | |

ROC (Receiver Operating Curve) Analysis (Hanley&McNell – Youden İndex J) AUC: Area under the ROC curve Se: Standard error CI: Confidence interval.
[a] Sensitivity.
[b] Specificity.
[c] Positive predictive value.
[d] Negative predictive value.
* Odds Ratio (%95 CI).

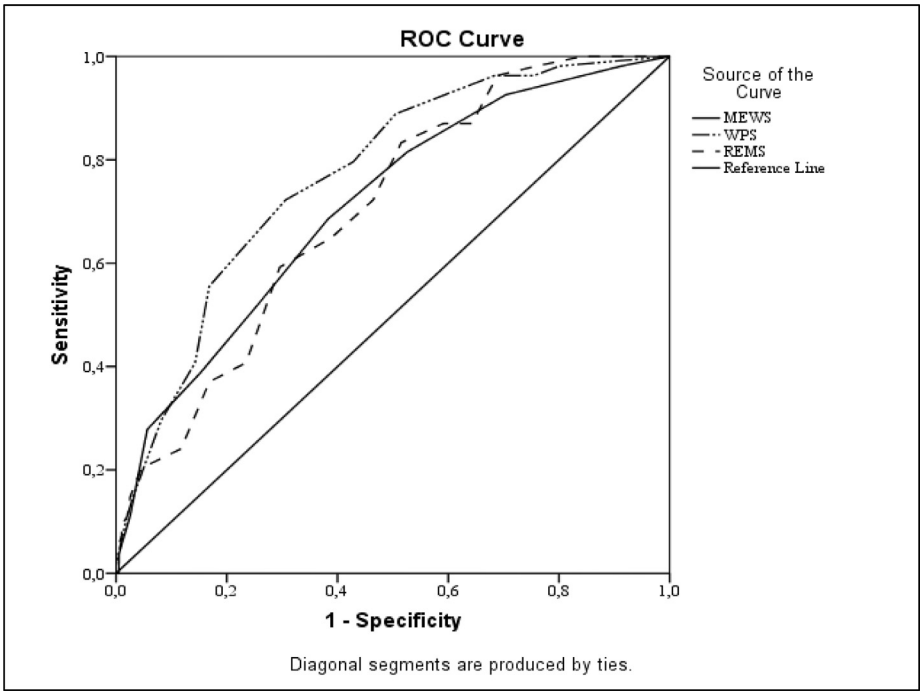


**Fig. 1.** Comparison of mortality predictive power of REMS, WPS and MEWS score in ROC curve.

**Table 8**
1 day, 5 day, 28 day survival rates and independent variables.

| Independent variables | B ± Se | p | Odds Ratio (%95 CI) |
|---|---|---|---|
| Systolic blood pressure | −0.689 ± 0.281 | 0.014 | 2 [1.1–3.5] |
| WPS score | −0.859 ± 0.332 | 0.010 | 2.4 [1.2–4.5] |
| 1 day survival rate (%) ± Se: (95.2 ± 1.3) | 5 day survival rate (%) ± Se: (88.7 ± 2.3) | 28 day survival rate (%) ± Se: (65.9 ± 7) | |

Cox Regression-Backward Stepwise (Wald) Method B: Regression coefficients Se: Standard error CI: Confidence interval.

university hospital. The hospital mortality was 21.6% and the AUC values were 0.76–0.79 for SCS, 0.74–0.79 for REMS, 0.73–0.75 for MEDS, and 0.65–0.70 for MEWS. As a result, the SCS and REMS were found to be the most appropriate scoring system in predicting the mortality of sepsis patients in general internal medicine departments [9].

In the present study, 250 patients who were taken to the intensive care unit from the emergency department due to internal diseases, surgery or trauma were studied. The mortality rate was 21.6% and the AUC values for mortality were found to be 0.769, 0.711 and 0.703 for WPS, MEWS, and REMS, respectively. In the present study, the predictive power of the REMS score on mortality was worse than that of two other scales. It is believed that the different outcomes of the two studies may be due to differences in the methods of both studies (such as patients who were hospitalized due to sepsis, all patients who were taken to the intensive care unit from the emergency department, and the prospective-retrospective and comparative scoring systems not to be identical) [10].

In another prospective study, MEDS, CURB-65 and modified REMS scores were examined in 2132 adult patients suspected of clinical infection. The mortality rate was 3.9% (83) and the mortality rate of patients increased as each score increased. All three scoring systems provided good predictions for 28-day hospital mortality [10]. In the present study, the mortality rate was 21.6%. Similarly, the higher the score of the patient, the greater was the risk of mortality. When the 28-day mortality rate was examined, 37% of those with a MEWS score of 5≤, 61.1% of those with a REMS score of 13 < and 35% of those with a WPS score of 5≤ died.

In a multi-center, prospective cohort study by Bulut et al., the MEWS and REMS scores were examined for the ability to predict the admission to a department or intensive care unit and hospital mortality in patients who were admitted to the emergency department with internal disease and surgical problems. The mortality rate of 2000 patients was 7.7% (153). REMS was found to be superior to MEWS both in determining critical illnesses and in predicting hospital mortality [4]. In the present study, all of the patients who were admitted to the emergency department and taken to the intensive care unit were examined retrospectively. The mortality rate, which was higher than other studies, was found to be 21.6%. It has been determined that WPS is superior to REMS and MEWS in predicting the hospital mortality in patients who were admitted to the emergency department and taken to the intensive care unit. REMS had the lowest rate. The fact that the methodologies of the two studies were different and the WPS score was not analyzed in the other study may be the reason for the differences in the outcomes.

In a study by Goodacre et al., REMS and RAPS scores were compared in predicting the hospital mortality of 5583 patients who were brought by the emergency ambulance and hospitalized. Age, GCS and oxygen saturation were determined to be the most important independent variables. In conclusion, REMS has been determined to predict mortality better than RAPS [11]. Differently, in the present study, the systolic blood pressure was the most important variable factor. The duration of stay in the intensive care unit and the mortality was found to be significantly correlated with SBP and WPS scores compared to other variables. It was found that the decrease in SBP doubled the mortality, and the increase in WPS increased the mortality 2.4 times.

The limitation of the study is the fact that it is single-centered and retrospective. Therefore, the number of patients may be low and the data from only one center may be shown. Apart from these, patients who were admitted to the emergency department and were hospitalized or discharged were not included in the study.

In recent years, many new scoring systems have been defined in

parallel with developments in technological and medical fields. When the existing studies in the literature are examined, it is seen that there are different and contradictory results. This is thought to be due to different patient populations, different scoring systems, different outcomes (such as hospitalization in the clinical or intensive care unit, 28th day or 30th-day hospital mortality) and the fact that studies are performed prospectively or retrospectively.

In conclusion, the scoring systems are useful in predicting prognosis with vital signs in the initial evaluation of patients who are admitted to the emergency department. Thanks to scoring systems, clinicians can act more easily in patient management (discharge, intensive care unit/clinic admission) when patients are admitted to the emergency department. In the present study, it was determined that the MEWS, REMS, and WPS scoring systems were significant in predicting mortality on the 1st, 5th and 28th days. The risk of mortality increases with the increasing scores. However, when the variables were analyzed considering the mortality and duration of stay in the intensive care unit, a more significant relationship was found between the WPS score and the mortality and duration of stay in the intensive care unit compared to other scores. The increase in the WPS increased the mortality by 2.4 times. However, for more precise results, there is a need for multicentered studies with a high number of patients and different patient groups.

## Conflict of interest

None.

## Ethical statement

The study was approved by the university non-interventional clinical research ethics board (28 October 2015-501).

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None.

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